Collaboration and analytics for optimal production and forecasting

Tom Fox, dynamicforecaster.com
29-Sep-2015, Aberdeen
Digital Energy Journal Forum on
Using analytics to improve production
Summary

• To maximise production we need to integrate different areas of technical expertise. We need to involve all levels in the organisation, asset equity partners and customers too.

• Integrated activity planning, rolling production forecasting and asset management must be aligned. For credible production forecasting, we have to reach a balanced view of uncertainties.

• How can we enable such collaboration across organisations and locations?

• Integrated Operations Centres are not the whole answer. People, Process, Technology and Organisation all need yet more attention to deliver improved workflows.

• A case-study of optimising gas-lift for many wells will show the benefits of collaboration for understanding the reservoir, production and facilities all brought together with insights from Operations.
From analytics to forecasts

Understanding the past, using analytics, helps to forecast future production

When we have analytics,

• Who understands them?
• How will we use them?
It’s a bad time to be poor at planning and forecasting

Challenges

• Low oil price
• High unit costs of mature offshore fields
• Aging platforms and pipelines infrastructure i.e. commercial, production and maintenance

Opportunities

• Lucrative production enhancements
• Share infrastructure to reduce unit costs
• Extending field life defers cost of abandonment
Collaborative analytics & forecasting

From analytics to better forecasts

Challenges in planning and forecasting

Impact of problems

What is needed to improve forecasting?

Design of collaborative analytics & forecasting

Implementation examples
Forecasting depends on complex planning

Integrated Activity Planning
• **Commercial** cash flows
• **Production** flows
• **Maintenance** logistics

but …
• **Complex decisions** are hard
• **Implementation** easily breaks down
A digital solution is an incomplete solution
Overloaded with misleading conclusions

If you skip the laws of physics and engineering, you are left with no way to handle the false alarms and false negatives from machine learning.
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Implementation examples
Quiz: Who can identify this …

- ~10% of North Sea oil and gas production
- An offshore production platform; a system node
- Unusually operating in ‘phase 1 mode’
- Maintenance Permit(s) to Work, e.g. PSV #504
- Hydrates in the gas compression system pipework, so stopped condensate pump B.
- Urgently started condensate pump A …
- Disaster
- US$1.4 billion insurance claims
- 167 lives lost in July 1988
We have not forgotten Piper A ...

Copyright image is accessible from the link below

http://www.bbc.co.uk/news/uk-scotland-22840445
https://en.wikipedia.org/wiki/Piper_Alpha
Missing integrated management

- ~10% of North Sea oil and gas production
- An offshore production platform; a system node
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Psychological traps impair decisions

- Over-relying on first thoughts: the anchoring trap
- Keeping on keeping on: the status quo trap
- Protecting earlier choices: sunk–cost trap
- Seeing what you want to see: the confirming–evidence trap
- Posing the wrong question: the framing trap
- Being too sure of yourself: the over-confidence trap
- Focusing on dramatic events: the recall-ability trap
- Neglecting relevant information: the base-rate trap
- Slanting probabilities and estimates: the prudence trap
- Seeing patterns where none exist: the out-guessing randomness trap
- Going mystical about coincidences: the surprised-by-surprises trap

Ref. Hammond, Keeney, & Raiffa, (1999). Smart Choices
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**What is needed to improve forecasting?**

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Implementation examples
Collaboration is not a luxury

It deserves purposeful investment of your time, energy and money
Collaboration on analysis

• Software to provide shared access to analysis
  • inputs
  • tools
  • results

• Integration of analysis
  • Multi-discipline expertise
  • Multi-role (operators, analysts, management, partners, vendors, customers).
  • Multi-location
  • Concurrent more than sequential
Communications are not a luxury

Everyone makes decisions at all levels in your organisation.

• Why not keep them informed?

• How can they participate in complex decisions?
Gradients of agreement is a better vocabulary than ‘Yes/No’ for team decision-making.

Source: Community at Work Gradients of Agreement Scale, 1996
Smart choices: a practical guide to better decisions

ProACT

• Work on the right decision Problem
• Specify your Objectives
• Create imaginative Alternatives
• Understand the Consequences
• Grapple with your Trade-offs
• Clarify your uncertainties
• Think hard about your risk tolerance
• Consider linked decisions
• Be aware of psychological traps
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Collaborative analytics & forecasting

Implementation examples
‘IDEA’ cycle of improvement

Primary processes for forecasting

- Manage opportunities and risks
- Plan and forecast multiple scenarios
- Review and learn from the past (use data)
- Work the Plan
- Use initiative
- Plan and forecast multiple scenarios
Collaborative events in planning cycle

- Identify
- Design
- Adjust
- Execute

- ‘Produce the Limit’ workshop
- Account for shortfalls and note opportunities
- Review and commit to plans and forecasts
- Operations coordination meetings
Collaborative analytics & forecasting

- Manage opportunities and risks
- Account for shortfalls and note opportunities
- Review and Learn from the past (use data)
- ‘Produce the Limit’ workshop
- Review and Learn from the past (use data)
- Review and commit to plans and forecasts
- Plan and forecast multiple scenarios
- Work the Plan
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- Operations coordination meetings
- Plan and forecast multiple scenarios
- Review and Learn from the past (use data)
- Manage opportunities and risks
- Account for shortfalls and note opportunities
- Review and Learn from the past (use data)
- ‘Produce the Limit’ workshop
Collaborative analytics & forecasting

- Manage opportunities and risks
- ‘Produce the Limit’ workshop
- Account for shortfalls and note opportunities
- Compare pairs of scenarios
- Review and Learn from the past (use data)

- Plan and forecast multiple scenarios
- Review and commit to plans and forecasts
- Operations coordination meetings
- Work the Plan
- Use initiative

Identify

Design

Adjust

Execute
Team access to analysis tools & data

Multi-user

Server and web browser interface

‘collective intelligence’

Local machine

• Excel
• Engineering simulators

Connect to Databases

One user

Slow data access

Fast and frequent data access

Enable collaboration

DynamicForecaster ©
Why move beyond spreadsheets?

- Error rate is unacceptable (refs. 1, 2)
- Hard to enforce version control
  - VBA coding is difficult to adapt
- Lack of security for multiple users
- Poor for rolling, repetitive updates
- Risk of bad business decisions

Implementation examples

DynamicForecaster, a multi-user, web-enabled analytics solution for collaboration on both production analysis and forecasting
Multiple users can run analyses
**Versatile for analytics & optimized forecasts**

<table>
<thead>
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<th>Virtual metering</th>
<th>Optimized scenarios</th>
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<td>4 scenarios * 240 rows</td>
<td>1 scenario * 1100 rows</td>
<td>8 scenarios * 100 rows * 12 m</td>
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<td>2 seconds (SQL-calc-SQL)</td>
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**DynamicForecaster**

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**Graphs:**
- **Case: Well_DCA A4 forecast**
- **CSG Well Monitor A7 Case: test**
**DynamicForecaster** is fast with Excel I/O

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**Case: Well_DCA A4 forecast**

**CSG Well Monitor A7 Case: test**
Oil wells: maximise oil production by optimised allocation of gas-lift supply

Gas injection

Optimum Gas Lift Region

Normal Gas Lift Operation

Unstable

Stable

Gas Injection (MMCSF/d)

Oil Production (STD/d)

Max Production

Network graphic courtesy of Schlumberger

Oil wells: optimised allocation of gas-lift supply

Optimized Oil rate and Gas-Lift Rate per well
for total gas-lift injection rate = 60 MMscf/d, total Oil production rate = 114946 bpd

Optimized Oil rate and Gas-Lift Rate per well
for total gas-lift injection rate = 60 MMscf/d, total Oil production rate = 113978 bpd

DynamicForecaster ©
Value-added by gas-lift optimisation

How to allow for future uncertainty in the total gas supply?

DynamicForecaster computes several optimised scenarios (at 0, 20, 40, 50, 60, 70 MMscf/d).

Baseline: operators are given the 40% of peak well injection gas rate for every well (perhaps from Excel)

Incremental oil should be valued at the NPV of accelerated production
DynamicForecaster with WebFOCUS by Information Builders

Web portal for actual production data compared with optimised gas-lift forecasts for 100 wells, 8 scenarios, monthly*12

http://www.informationbuilders.co.uk/products/intelligence
Collaborative analytics & forecasting

Challenges in planning and forecasting
  • Integrate commercial, production and maintenance

Impact of problems
  • Don’t have a disaster

What is needed to improve forecasting?
  • Collaboration defends against psychological traps

Design of collaborative analytics & forecasting
  • Processes and events for continuous improvement

Implementation examples
  • Well forecasting, virtual metering, gas-lift optimisation
  • High value from optimised forecasts with multiple scenarios
Know sooner, decide better, act faster

Collective human intelligence
Engineering algorithms
Fast and frequent (big) data

http://dynamicforecaster.com/